AMENDMENTS TO THE CLAIMS

1. (Previously Presented) An optical amplification device, comprising:

a first segment of active optical fiber having a first end portion coupled to an optical communication path carrying a plurality of optical signals, each at a respective one of a plurality of wavelengths, and a second end portion, said first segment of active optical fiber receiving the plurality of optical signals through the first end portion and outputting the plurality of optical signals through the second end portion;

a dispersion compensating element optically coupled to the second end portion of said first segment of active optical fiber;

a second segment of active optical fiber having a first end portion coupled to said dispersion compensating element and carrying a plurality of dispersion compensated optical signals, each at a respective one of a plurality of wavelengths, and a second end portion, said second segment of active optical fiber receiving the plurality of optical signals through the first end portion and outputting the plurality of dispersion compensated optical signals through the second end portion;

a variable optical attenuator having an input port coupled to the second end portion of said second segment of optical fiber, said variable optical attenuator having a control port that receives an attenuation control signal and an output port, said

input port of said variable optical attenuator receiving the plurality of dispersion compensated optical signals;

a third segment of active optical fiber having a first end portion coupled to the output port of said variable optical attenuator and a second end portion, the plurality of dispersion compensated optical signals propagating through said variable optical attenuator and being supplied to the first end portion of said third segment of active optical fiber via the output port of said variable optical attenuator, the plurality of ispersion compensated optical signals being output from said third segment of active optical fiber via the second end portion of said third segment of active optical fiber; and

a control circuit operatively coupled to the optical communication path, said control circuit sensing an input optical power of at least one of the plurality of optical signals input to the first end of said first segment of active optical fiber and inputting a dispersion compensating element loss value representative of a power loss across said dispersion compensating element, said control circuit outputting the attenuation control signal in response to the input optical power and the dispersion compensating element loss value,

said variable optical attenuator attenuating the plurality of optical signals in response to the attenuation control signal such that a gain profile of the plurality of dispersion compensated

optical signals output from the second end portion of said third segment of active optical fiber is flattened,

said control circuit including:

an attenuator offset value storage device operatively connected to said control circuit, said attenuator offset value storage device storing an attenuator offset value;

said control circuit inputting the attenuator offset value from said attenuator offset value storage device and outputting the attenuation control signal in response to the input optical power, the dispersion compensating element loss value and the attenuator offset value.

2. (Previously Presented) The optical amplification device in accordance with claim 1, said control circuit including:

a photodetector operatively coupled to the first end portion of said first segment of active optical fiber, said photodetector sensing the input optical power of at least one of the plurality of optical signals input to the first end of said first segment of active optical fiber and outputting an electrical signal in response thereto;

a memory device storing the dispersion compensating element loss value representative of a power loss across said dispersion compensating element;

a processing unit operatively coupled to said photodetector and to said memory device, said processing unit receiving the electrical signal from said photodetector and the dispersion compensating element loss value from said memory device; said processing unit outputting the attenuation control signal in response to the electrical signal, the attenuator offset value, and the dispersion compensating element loss value.

3. (Previously Presented) The optical amplification device in accordance with claim 1, said control circuit including:

a first photodetector operatively coupled to the first end portion of said first segment of active optical fiber, said photodetector sensing the input optical power of at least one of the plurality of optical signals input to the first end of said first segment of active optical fiber and outputting an electrical signal in response thereto;

a second photodetector operatively coupled to an input port of said dispersion compensating element, said second photodetector sensing an optical input power associated with the plurality of optical signals input to said dispersion compensating element and outputting a second electrical signal in response thereto;

a third photodetector operatively coupled to an output port of said dispersion compensating element, said third photodetector sensing an optical output power associated with the plurality of

dispersion compensated optical signals output from said dispersion compensating element and outputting a third electrical signal in response thereto;

a memory device storing a reference span loss value indicative of a span loss associated with a preceding span to which said first segment of active optical fiber is operatively connected and a reference dispersion compensating element loss value representative of a reference power loss across said dispersion compensating element;

a processing unit operatively coupled to said first, second and third photodetectors and to said memory device, said processing unit receiving the first, second and third electrical signals from said first, second, and third photodetectors and the reference span loss and dispersion compensating element loss values from said memory device; said processing unit outputting the attenuation control signal in response to the first electrical signal, the second electrical signal, the third electrical signal, the reference span loss value, the attenuator offset value, and the dispersion compensating element loss value.

4. (Previously Presented) The optical amplification device in accordance with claim 1, said control circuit including:

a first photodetector operatively coupled to the first end portion of said first segment of active optical fiber, said

photodetector sensing the input optical power of at least one of the plurality of optical signals input to the first end of said first segment of active optical fiber and outputting an electrical signal in response thereto;

a second photodetector operatively coupled to an input port of said variable optical attenuator, said second photodetector sensing an optical input power associated with the plurality of optical signals input to said dispersion compensating element and outputting a second electrical signal in response thereto;

a third photodetector operatively coupled to an output port of said dispersion compensating element, said third photodetector sensing an optical output power associated with the plurality of dispersion compensated optical signals output from said dispersion compensating element and outputting a third electrical signal in response thereto;

a comparator operatively connected to said second and third photodetectors and receiving the second and third electrical signals, said comparator comparing the second and third electrical signals and generating the dispersion compensating element loss value in response thereto;

a memory device storing a reference span loss value indicative of a span loss associated with a preceding span to which said first segment of active optical fiber is operatively connected and a reference dispersion compensating element power loss value

representative of a power loss across said dispersion compensating element;

a processing unit operatively coupled to said first photodetector, said comparator, and said memory device, said processing unit receiving the first electrical signal from said first photodetector; the dispersion element power loss value from said comparator; and the reference span and dispersion element power loss values from said memory device; said processing unit outputting the attenuation control signal in response to the first electrical signal, the dispersion element power loss value; the reference span power loss value, the attenuator offset value, and the dispersion element power loss value.

5. (Previously Presented) The optical amplification device in accordance with claim 1, said control circuit including:

a first photodetector operatively coupled to the first end portion of said first segment of active optical fiber, said photodetector sensing the input optical power of at least one of the plurality of optical signals input to the first end of said first segment of active optical fiber and outputting an electrical signal in response thereto;

a second photodetector operatively coupled to an input port of said variable optical attenuator, said second photodetector sensing an optical input power associated with the plurality of optical

signals input to said dispersion compensating element and outputting a second electrical signal in response thereto;

a third photodetector operatively coupled to an output port of said dispersion compensating element, said third photodetector sensing an optical output power associated with the plurality of dispersion compensated optical signals output from said dispersion compensating element and outputting a third electrical signal in response thereto;

a dispersion compensating element loss error calculator operatively connected to said second and third photodetectors and receiving the second and third electrical signals, said dispersion compensating element loss error calculator calculating a dispersion compensating element loss error based on the second and third electrical signals and a reference dispersion compensating element loss value;

a span loss error calculator operatively connected to said first photodetector and receiving the first electrical signal, said span loss error calculator calculating a span loss error based on the first electrical signal and a reference span loss value;

a processing unit operatively coupled to said dispersion compensating element loss error calculator and said span loss error calculator, said processing unit receiving the dispersion compensating element loss error and the span loss error; said processing unit outputting the attenuation control signal in

response to the dispersion compensating element loss error, the attenuator offset value, and the span loss error.

6. (Cancelled)

7. (Original) The optical amplification device in accordance with claim 1, further comprising:

an optical filter having an input port coupled to the second end portion of said second segment of active optical fiber and an output port coupled to the input port of said variable optical attenuator.

8. (Original) The optical amplification device in accordance with claim 7, wherein said optical filter is a gain flattening filter.

9. (Original) The optical amplification device in accordance with claim 7, wherein said optical filter includes an additional input port and an additional output port, said optical amplification device further comprising:

a service channel transmitter coupled to the additional input port of said optical filter, said service channel transmitter supplying first optical service signals at a wavelength different than the plurality of optical signals to the additional input port of said optical filter, the first optical service signals being

output through the output port of said optical filter to the input port of said variable optical attenuator; and

a service channel receiver coupled to the additional output port of said optical filter, said service channel receiver sensing second optical service signals output from the additional output port of said optical filter.

10. (Original) The optical amplification device in accordance with claim 1, further comprising:

a first optical filter having an input port coupled to the second end portion of said second segment of active optical fiber and an output port coupled to the input port of said variable optical attenuator; and

a second optical filter having an input port coupled to the output port of said variable optical attenuator and an output port coupled to the fist end portion of said third segment of active optical fiber.

11. (Original) The optical amplification device in accordance with claim 10, wherein said first and second optical filters are gain flattening filters.

12. (Original) The optical amplification device in accordance with claim 10, wherein said first optical filter includes an additional

output port and said second optical filter includes an additional input port, said optical amplification device further comprising:

a service channel receiver coupled to the additional output port of said first optical filter, said service channel receiver sensing first optical service signals output from the additional output port of said first optical filter, the first optical service signals being at a wavelength different than the plurality of optical signals; and

a service channel transmitter coupled to the additional input port of said second optical filter, the first optical service signals being output through the output port of said second optical filter to the first end portion of said third segment of active optical fiber.

13. (Original) The optical amplification device in accordance with claim 1, wherein said dispersion compensating element includes dispersion compensating fiber.

14. (Original) The optical amplification device in accordance with claim 1, wherein said dispersion compensating element includes a dispersion compensating Bragg grating.

15. (Original) The optical amplification device in accordance with claim 1, wherein said first segment of active optical fiber and

said second segment of active optical fiber provide high gain and a low noise figure relative to said third segment of active optical fiber which is pumped to provide a high optical conversion efficiency relative to said first and second segments of active optical fiber.

16. (Original) The optical amplification device in accordance with claim 1, further comprising:

a first pump optically coupled to said first segment of active optical fiber, said first pump operating at 980nm;

a second pump optically coupled to said second segment of active optical fiber, said first pump operating at 980nm;

a third pump optically coupled to said third segment of active optical fiber, said first pump operating at 1480nm and providing copropagating pumping light; and

a fourth pump optically coupled to said third segment of active optical fiber, said first pump operating at 1480nm and providing counterpropagating pumping light.

17. (Original) The optical amplification device in accordance with claim 16,

said first and second pumps providing high gain and a low noise figure to said first and second segments of active optical fiber relative to said third segment of active optical fiber; and

said third and fourth pumps providing a high optical conversion efficiency to said third segment of active optical fiber relative to said first and second segments of active optical fiber.

18. (Original) An optical communication apparatus, comprising:

a plurality of optical transmitters, each emitting a corresponding one of the plurality of optical signals, each of the plurality of optical signals being at a respective one of a plurality of wavelengths;

an optical combiner having a plurality of inputs, each of which being coupled to a respective one of said plurality of optical transmitters, and an output supplying the plurality of optical signals to a first end portion of an optical communication path;

a plurality of optical amplification devices according to claim 1, said optical amplification devices arranged in series along the optical communication path;

an optical demultiplexer having an input configured to be coupled to a second end portion of the optical communication path, and a plurality of outputs, each of the plurality of outputs of said optical demultiplexer supplying a respective one of the plurality of optical signals;

a plurality of optical receivers, each of which being coupled to a respective one of the plurality of outputs of said optical demultiplexer;

a plurality of received power modules, each of which being coupled to a respective one of said plurality of receivers, each of said plurality of received power modules outputting a respective one of a plurality of power level signals indicative an optical power received at each of said plurality of receivers;

a monitoring circuit coupled to each of said plurality of received power modules, said monitoring circuit receiving the plurality of power level signals and outputting an adjustment signal in response to the plurality of power level signals; and

a plurality of tilt control circuits coupled to each of said plurality of optical amplification devices, each of said plurality of tilt control circuits receiving the adjustment signal from said monitor circuit, said tilt control circuits adjusting a gain tilt associated with each of said optical amplification devices in response to the adjustment signal.

19. (Previously Presented) A method of controlling an optical amplification device having a first, second and third amplification stages and connected to a span having a span loss that may vary, comprising:

a first amplifying step amplifying a plurality of optical signals each at a respective one of a plurality of wavelengths with the first amplification stage;

dispersion compensating the plurality of optical signals output from the first amplification stage;

a second amplifying step amplifying the plurality of dispersion compensated optical signals with the second amplification stage;

optically attenuating the dispersion compensated optical signals output from the second amplification stage;

a third amplifying step amplifying the optically attenuated signals with the third amplification stage;

sensing an input optical power of at least one of the plurality of optical signals input to the first amplification stage;

controlling said optically attenuating step to optically attenuate the dispersion compensated optical signals output from the second amplification stage according to the input optical power sensed by said sensing step and a dispersion compensating element loss value;

said optically attenuating step optically attenuating the plurality of dispersion compensated optical signals such that a gain profile of the plurality of dispersion compensated optical signals output from the third amplification stage is flattened; and

storing an attenuator offset value;

said controlling step controlling said optically attenuating step to optically attenuate the dispersion compensated optical signals output from the second amplification stage according to the input optical power sensed by said sensing step, the dispersion compensating element loss value; and the attenuator offset value stored by said storing step.

20. (Original) The method of controlling an optical amplification device in accordance with claim 19, further comprising:

storing the dispersion compensating element loss value representative of a power loss resulting from said dispersion compensating step.

21. (Original) The method of controlling an optical amplification device in accordance with claim 19, further comprising:

sensing the dispersion compensating element loss value representative of a power loss resulting from said dispersion compensating step.

22. (Cancelled)

23. (Original) The method of controlling an optical amplification device in accordance with claim 19, further comprising:

filtering the plurality of signals between the second and third amplification stages with a gain flattening filter.

24. (Original) The method of controlling an optical amplification device in accordance with claim 19, further comprising:

providing a high gain and a low noise figure with the first and second amplification stages relative to the third amplification stage;

provide a high optical conversion efficiency with the third amplification stage relative to the first and second amplification stages.

25. (New) An optical amplifier for a wavelength division multiplexed communication system carrying a wavelength division multiplexed signal in an optical transmission line, comprising:

a first optical amplifier stage having an input optically coupled to the optical transmission line, said first optical amplifier stage receiving and amplifying the wavelength division multiplexed signal;

a dispersion compensating element optically coupled to an output of said first optical amplifier stage;

a second optical amplifier stage having an input optically coupled to an output of said dispersion compensating element, said second optical amplifier stage receiving and further amplifying the

amplified and dispersion compensated wavelength division multiplexed signal;

a variable optical attenuator optically coupled to an output of said second optical amplifier stage, said variable optical attenuator having a control port that receives an attenuation control signal, said variable optical attenuator attenuating the amplified, dispersion compensated signal from said second optical amplifier stage according to the attenuation control signal;

a third optical amplifier stage having an input optically coupled to an output of said variable optical attenuator, said third optical amplifier stage receiving and further amplifying the signal from said variable optical attenuator and outputting the resulting signal to the optical transmission line; and

a controller operatively coupled to the optical transmission line and to said variable optical attenuator, said controller outputting the attenuation control signal to said variable optical attenuator;

said variable optical attenuator attenuating the amplified, dispersion compensated signal from said second optical amplifier stage according to the attenuation control signal such that a gain profile of the wavelength division multiplexed signal output from the third optical amplifier stage is substantially flattened,

said controller further including:

a photodetector optically coupled to the input of said first optical amplifier stage, said photodetector sensing the input optical power the wavelength division multiplexed signal input to said first optical amplifier stage and outputting an electrical signal in response thereto;

a memory device storing the dispersion compensating element loss value representative of a power loss across said dispersion compensating element;

a processing unit operatively coupled to, said photodetector and to said memory device, said processing unit receiving an attenuator offset value, the electrical signal from said photodetector and the dispersion compensating element loss value from said memory device; said processing unit outputting the attenuation control signal in response to the attenuator offset value, the electrical signal, and the dispersion compensating element loss value,

wherein said first and said second optical amplifier stages provide high gain and a low noise figure relative to said third optical amplifier stage, and

wherein said third optical amplifier stage provides a high optical conversion efficiency relative to said first and second optical amplifier stages.